The American Biology Teacher

A service publication of
The National Association of Biology Teachers
teaching biological sciences from elementary grades through college

OCTOBER
1952

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A School Forest

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Cave Biology

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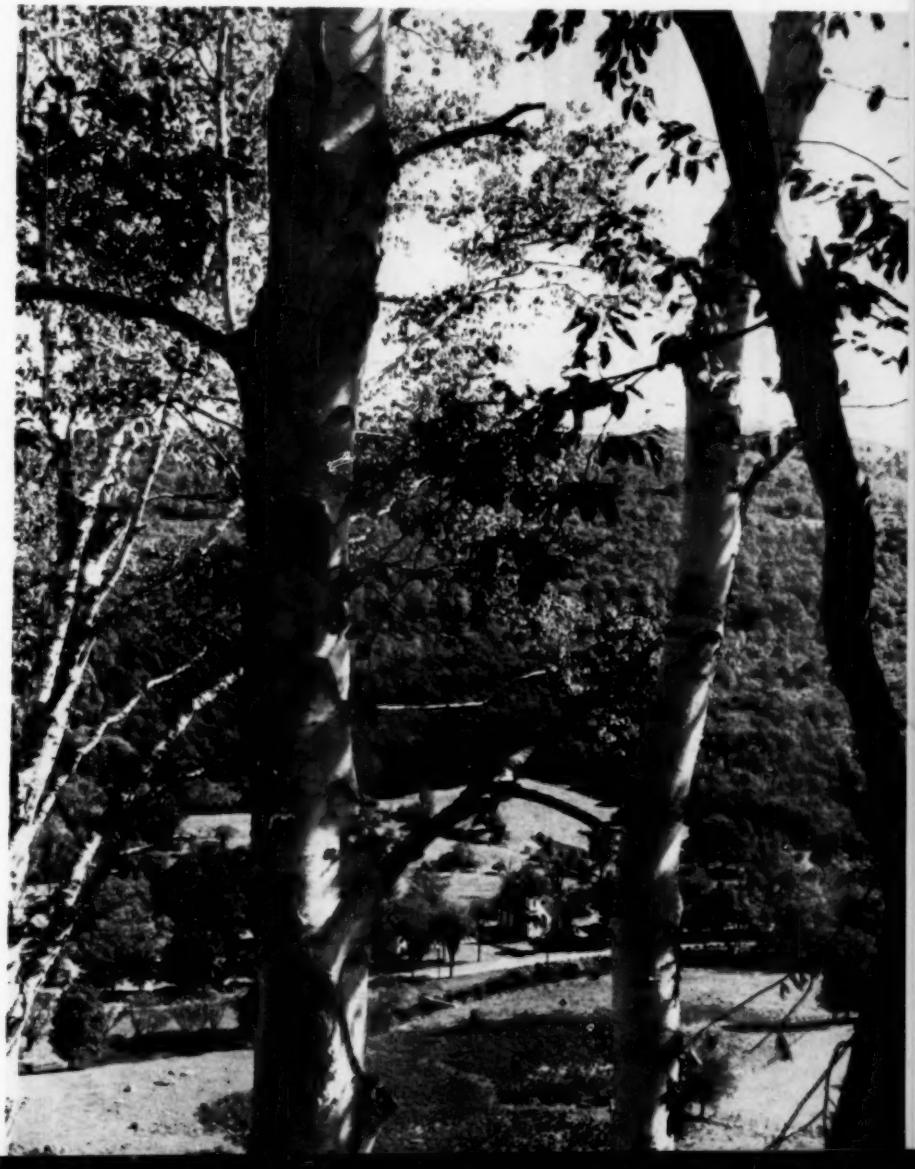
Vol. 14, No. 6



THE AMERICAN BIOLOGY TEACHER

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The entire Staff List will be found in the March and November issues.

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THE COVER PICTURE

was supplied by Donald S. Lacroix of Amherst, Massachusetts. It is a view of Tyringham Valley, south of East Lee, in the Berkshires. It was taken with a 9 × 12 cm. Voigtlander camera. Mr. Lacroix has written many articles for ABT, and most of them have been illustrated.

The American Biology Teacher

Vol. 14 OCTOBER, 1952 No. 6

A School Forest and Botanical Garden

MELVIN BROWN

Teacher of Biology, Kitzmiller High School, Kitzmiller, Maryland

In the fall of 1948 there were 7.7 acres of playground and undeveloped land surrounding Kitzmiller High School. Members of the biology class became interested in the names of trees and shrubs, during a tour of this area, prior to a study of native plant life. It was suggested that the names be placed on or near the trees and shrubs for the benefit of those who would take part in the study. It was from this interest that a project evolved in which every class took part and continues to share.

During the labeling of the trees it was noticed that many of the desirable species were hampered in their development by briers and undesirable undergrowth. Plans were made to clear about two acres of the undeveloped area. Among the species to be labeled and retained were oaks, dogwood, cucumber, beech, witch hazel, sassafras, gum, laurel, locust, ash, sumac, linden, wild cherry, poplar and maples.

After the area was cleared, the idea was brought forward that other species should be added. The State Forestry Service of Maryland was contacted in a quest for additional specimens particularly suited to the climate of this area. The initial contribution of the State Forestry Service was two truck-loads of trees, ranging from seedlings to trees ten feet in height. Pupils from the biology class went to the state forest, dug the trees, and were responsible for replanting, staking, trimming, and labeling the evergreens. The following kinds of trees were included in this group: balsam fir, red spruce, white pine, larch, and red pine. These are not natives of our valley region. Hemlock is the only native conifer.

After the area had been cleared, its recreational possibilities were realized. Walks and fireplaces were constructed from rocks secured when the area was cleared. Bird houses and feeders were built to entice birds to make their home in "The Park," as it was now being called. Picnic tables were built near the fireplaces for those of the school and the community who wished to use these facilities.

To add to the botanical value and beauty of the area, a continuous effort has been made to collect every available species of native flowers, shrubs, and

A view from the lower end of Kitzmiller High School Botanical Garden, looking toward the town of Kitzmiller, Maryland. The boys are laying flagstones around one of the fireplaces. The town of Kitzmiller is located in Garrett County, along the north branch of the Potomac River, the western-most county of Maryland.

trees, as well as rare and ornamental varieties. Special effort was made to find trailing arbutus and lady slippers, both of which are becoming rare in this section, and to place them in locations conducive to their growth. Over 5000 bulbs, including tulips, crocus, daffodils and hyacinths, have been added to the collection. For the observance of Arbor Day, each class and the Parents' and Teachers' Association raised funds and obtained many rare trees for the project. Citizens of the town have cooperated by contributing lilacs, roses, and many other flowering shrubs. The Maryland State Conservation Service provided cover and food plants for wildlife.

In the spring of 1950, the local Lions Club presented to the school two acres of hill land which adjoin the original park area. Water from a mine had destroyed much of the vegetation on this land. The water which pours down a steep slope was channelled, and serves as the power to turn a water wheel. Soil tests were made and lime was added to the soil to neutralize the acid. This land is now being reforested.

Every pupil has taken part in the study and work necessary to make this project possible. They have been challenged to gain deeper understandings, and have found new interests in the field of biological science. Studies have been made of the natural habitats of the plants and animals, and every effort was made to reconstruct these ecological conditions. Fertilizers of many kinds have been used, and the soil requirements have been studied. The propagation of many types of plants has been tried and proved generally successful.

In the fall of 1950, the biology class published a 40-page mimeographed booklet * of the plant life in the area. This booklet contains diagrams, leaf prints, and descriptions of the most common plants. The prints were made by coating the lower surfaces of leaves with black soot from a candle, and then pressing the leaves on white sheets of paper. The prints were then traced with India ink, and from these tracings stencils were cut. The booklets are used in the science classes when making collections or labeling plants.

At the present time this botanical project contains over 600 species or varieties of plants ranging from mosses, lycopodiums and ferns to Nemopanthus, Port Orford Cedar, Concolor Fir, Ginkgo and Sequoia. Some of the specimens have been obtained from state agencies as far away as Washington and Oregon. The Curriculum Division of the Maryland State Department of Education is making a series of color slides of the activities involved in the development of the project. These will be used by the schools of Maryland.

* Ass't Editor's note: A copy of this interesting 42-page booklet is available in the Ass't Editor's office, or arrangements may be made to examine the booklet by contacting Mr. Brown.

ABT gets in

Editor's Note: A beautifully illustrated story of this project, entitled *A Wilderness Turned Wonderland*, appeared in the August 31, 1952 issue of the Metrogravure magazine section of the *Baltimore Sunday Sun*. It was a "Sunstory-in-Pictures" feature by John Ahlers, of the Sun staff.

Biology in the News

Sheep Are Crazy Critters by Paul Schubert, *Sat. Ev. Post*, Sept. 13, 1952, pp. 36–37 & 120–125.

Are sheep easily raised and cared for? Are sheepherders really lonely? Many such questions are answered in this interesting account of sheep raising on the plains and in the mountains of Wyoming.

Science May Give You a Second Heart by John Lear, *Colliers*, Sept. 27, 1952, pp. 22–24.

Injuries to the heart by accident or disease need not be fatal. Recent developments in heart surgery hold hope for even the more serious.

Too Smart to Kill by Roger M. Latham, *Hunting and Fishing*, Sept. 1952, pp. 20–21 & 56–59.

Some hunters concepts as to how animals have adapted themselves to the antics of their natural enemy—man the hunter.

What You Don't Know About Your Eyes by Carle Hodge, *Colliers*, Sept. 6, 1952, pp. 20–22.

An informative article on our eyes and the disorders which are common to them.

Are You Playing with Death by Bruce Bliven, Jr., *Redbook*, Sept. 1952, pp. 30–31 & 70–73.

Souvenir firearms are killing 3000 people annually. Keeping them around the home is hazardous to all, to the novice as well as to the experienced.

Toxic Thyroid by Maxine Davis, *Good Housekeeping*, Sept. 1952, pp. 13 & 194–196.

A reasonably simple account of the activity of the thyroid and what to do when it functions abnormally.

Bears Are No Darn Good by Harold H. Martin, *Sat Ev. Post*, Sept. 20, 1952, pp. 19–21 & 122–127.

Bears kill cattle and sheep grazing near National Parks in Western North Carolina. The farmers object when National Park rangers protect the bears. A satisfactory solution to this problem has not been found.

Editor's Note: If you find in the popular press any articles which you think are of particular importance, even though they are a few weeks or months old, send one-sentence reviews of them to Brother H. Charles, F.S.C., *Saint Mary's College, Winona, Minnesota*, who is in charge of this column.

Cave Biology as a Unit of Study

BROTHER G. NICHOLAS, F.S.C.
La Salle High School, Cumberland, Maryland

Although there are at least 4000 caves in the United States, some so large that their area is measured in square miles, a perusing of over a dozen standard college and high school textbooks failed to disclose one which mentioned any aspect of cave biology. The writer has been informed by the authors of two forthcoming college textbooks and one high school textbook that they plan to include sections dealing with plant and animal life in caves, but this is apparently the limit to which the topic is treated in biology books. This is a regrettable situation, since caves form a distinct biotic unit just as seashore or desert life would be independent topics. Not only are there many unique types of organisms found in caves, but many illustrations of such fundamentals as evolution, symbiosis, tropisms, food cycles, etc., are found in this study of the underground.

In the first place, merely mentioning the word " cave " or " cavern " immediately attracts the attention of students, since these terms seem to connote something mysterious and fascinating. Actually, caves were probably man's first permanent type of dwelling and students should not feel that the ecology of a cave is a study of something mysterious at all. It is far easier to initiate a discussion of organisms which lack epithelial pigmentation, by referring to certain types of white crayfish found in caves of the Ozark region, than by merely drawing a diagram showing the difference between pigmented and non-pigmented skin.

Undoubtedly, the best-known inhabitants of caves are bats. These flying

Photo by: Charles E. Mohr

Clusters of bats hibernating in a cave. Huddling in swarms maintains body heat.

mammals afford an excellent example of limb modification, since the forelimbs have a membrane attached which acts as a wing, and the toes are able to grasp hold of the slightest niche and thus enable the bat to rest by hanging upside down. The economic importance of bats is not to be overlooked since they feed mainly on insects and, on summer nights, will devour large numbers of these. Also, bat guano is an excellent fertilizer. Some writers think that the formation of salt-

petre in caves is due to the action of bacteria on animal excreta. If this is true, then bats actually are a source of income for those engaged in mining this chemical from caves. A little known fact about bats is that mating occurs in the fall, but the eggs are not fertilized until the end of the hibernation period. The spermatozoa survive in the female until the eggs are freed. The young bat is carried by the mother until old enough to fly.

H. B. Hitchcock, Middlebury College, Vermont, and C. E. Mohr, Director of the Audubon Nature Center, Greenwich, Conn., in studying the sex ratio of hibernating bats, have found that males predominate, at least in the northern section of the country. Mohr[1] has found as high as a three to one ratio for males, and Hitchcock has found that this figure applies to most species studied in eastern Canada.[2] Allied with this study is that of the migration of bats. By the use of banding, it has been determined that bats commonly return to the same cave year after year.

Of course, an explanation of the sense of location is always called for when speaking of bats. The use of ultrasonic waves by the bats should be familiar to all, yet a leading pocket-sized magazine stated several months ago that bats determined their location by radar. Obviously this is incorrect, since the bat has not the means for either sending or receiving electrical impulses.

The famous blind fish found in caves can serve as a demonstration of adaptive evolution. Although not affected by light, these fish are sensitive to vibrations in the water, this stimulation being picked up by papillae which cover the head of the fish. Therefore, such fish detect food not because of a hyperdelicate sense of smell, but by the vibrations set up by the movement of their prey.

Photo by: Charles E. Mohr

Eyeless fish are found in caves of the Ozark Mountains region.

Salamanders are another type of vertebrate indigenous to caves. Both blind species and those with sight are found, the latter being more common. As in the case of fish, colorless salamanders are occasionally found. These forms seem to be quite rare in the East, but are found in the South and Midwest of this country. If one is fortunate enough to obtain a colorless salamander, cutaneous respiration can be effectively demonstrated, since a network of blood vessels can be observed which give a pinkish tint to the body.

The phylum Arthropoda has the greatest number of representatives peculiar to caves. Numerous isopods, amphipods, crayfish, insects and millipedes have been reported. The harvestman or daddy-long-legs, crickets, and mosquitoes are particularly abundant in several caves and almost any cave will be found to contain beetles and flies, although one usually has to spend some time searching for them. The writer on one occasion was forced to leave a small crawlway after disturbing thousands of mos-

[1] Mohr, C. E., 1945, "Sex Ratios of Bats in Pennsylvania," *Proc. Penna. Acad. Sci.*, Vol. 19, pp. 65–69.

[2] Hitchcock, H. B., 1950, "Sex Ratios in Hibernating Bats," *Bulletin, Nat. Spel. Soc.*, Vol. 12, pp. 26–28.

Photo by: Charles E. Mohr

Cave crickets feel their way with long antennae.

quitoes inhabiting this particular cave. As would be expected, crayfish are found in any cave which has a stream flowing through it, although some forms have been isolated from light for such a long period of time that the eyes are vestigial.

Several types of Platyhelminthes exist in caves, with planaria being the most common. Snails are found, but in many cases have been washed in and have been able to survive. Even hydras and sponges have been reported as flourishing in tunnels and sink-hole caves.

Cavern flora include true molds and other fungi, although types of algae and mosses are sometimes seen in caves which have permanent lighting. Wood in caves is almost immediately attacked by slime molds. In fact, the Stratosphere Balloon Cave near Riverton, West Virginia, has sheets of white mold growing on wood used when the cave was commercially handled. One sheet, measured by the writer, stretched from the railing to the floor of a deserted stairway and extended the length of the stairs. Green plants sometimes are found inside a cave when sunlight can get to them for at least some time during the day. These specimens are either close to the entrance or near a hole in the ceiling.

An outstanding example of a food cycle is seen in the manner in which cave creatures exist. Isopods and planaria feed on guano and decaying organisms, these organisms either having died in the cave or been washed in. Insect forms feed on fungi which, in turn, grow on decaying leaves and wood. These insects and the isopods are food for the fish, salamanders, crayfish and even for the frogs occasionally seen. The larger organisms need fear no predators, except for skunks or raccoons whose dens are found near the entrance to a cave.

One aspect of the uses of caves to those teaching conservation is their use as a shelter. Even in the wintertime the temperature remains constant at about 54 degrees, so that many creatures either hibernate or lead active lives in caves, using them as dens during bad weather. The bat is the classic example of hibernation, but many types of small quadrupeds use a cave for the same purpose. Bears, incidentally, rarely hibernate in caves. Amphibia, such as salamanders and frogs, migrate to caves. Even rats are found in caves and that mischievous little fellow, the pack rat, has been known to steal the supplies of Speleologists engaged in exploration.

If the teaching of a unit on cave biology can be integrated with a trip through a cave, the lesson is far more impressive. Since an article appearing in *The American Biology Teacher* last year covered this phase of cave biology,[3] there is no need to give details here. It should be pointed out, however, that very little in the line of live specimens can be seen in commercial caves, since the presence of so many people scares many forms away. That the study of cave biology can be of more than passing interest is attested by the fact that one of the winners in the Eighth Annual Westinghouse Science Talent Search, Thomas C. Barr, submitted as his essay a study of Cave Ecology with special reference to Ten-

[3] Nicholas, Brother G., F.S.C., 1951, "Cave Exploring on Field Trips," *The American Biology Teacher*, Vol. 13, No. 5, pp. 112–113.

Photo by: Charles E. Mohr

A typical salamander (*Eurycea longicauda lucifuga*) found in caves from Virginia to Oklahoma. Length 6 inches.

nessee caverns. This paper was later printed in Bulletin 11 of the National Speleological Society—this group being the official organization in this country devoted to the study of caves. Some colleges have organized groups of students into "Grottoes" and have explored the caves of their region. Since the science of Speleology is rapidly becoming better known, teachers should have even more reasons for including a section on cave biology in their course.

Using the Community as a Laboratory

JOHN P. HARROLD
Senior High School, Midland, Michigan

Nearly all communities offer opportunities for observing practical uses for biological principles. The impressions that students get from seeing first hand such activities are far more lasting than those read from any textbook page.

There are pupils in most high schools that some day hope to become doctors, nurses, health workers, laboratory technicians, science teachers, and the like. Why not expose these students, not only to the high school laboratory, but to as many applications of biological work outside the school as can be found?

To do this a careful survey of the community's resources should be made and a series of field trips planned to include as many as possible. Already, I hear the cries go up, "Field trips! How can you plan field trips without getting into the rest of the faculty's hair? How can you arrange transportation without school buses? How can you plan a good field trip for one class period? How do you know whether or not students get anything out of a field trip but a good time?"

It looks as if I let myself in for something. But let me try to answer the questions first so that you will try out something for yourself. To keep the faculty happy, I send out a notice ten days in advance with names of all the pupils going on the field trip, the date, time and the class periods that may be missed. I have it approved by the Principal first.

We do not have school buses, but I

find little trouble in getting pupils to drive cars when necessary. In a pinch, parents have always helped us. Oh! Oh! Do I hear someone saying something about responsibility? To my way of thinking, that is a lame excuse for not taking field trips. If the trip is to be a long one, and over a considerable distance from the school, written permission is secured from the parents. The pupil is expected to obey orders. If he does not, he is left behind the next time.

How do I plan a field trip for one class period? Every school will have its own problems to work out in scheduling field trips. The answer is careful advance planning and cooperation. I feel that few Principals or Superintendents will refuse to try to work out a satisfactory solution with you. There are several ways of handling the time factor. One way is to schedule study periods so that pupils have one following or preceding the biology period. When this is not practical, trips which consume only the biology class period may have to be used, and the school campus or nearby neighborhood will have to serve as the field trip area. There will be times, however, when it will be necessary to take additional time from the next class period. There should be no objections if pupils, faculty, and administrators have had the necessary advance notice.

Where no other possibility presents itself, and there is sufficient interest, special after-school or Saturday field trips are in order. You will not regret the extra time and effort on your part. It is an excellent opportunity to get really close to your students. I find that two or three such field trips each semester can be fun! Everyone packs a lunch and off we go. I do not get too alarmed if Joe seems more interested in Mary than in the scientific name of some flower. Mary is probably the reason Joe came along. Remember that biology includes human relationships, and where is there a better time to stress co-operation, companionship, and courtesy than on a field trip?

The answer to the question, "Do students get anything out of a field trip?" depends almost entirely on the teacher. Students usually get something out of a well-planned field trip. If the students help with the planning, they get even more out of it. I find that a field trip usually covers four days: one day to plan the trip with the class and to get ready; the field trip day; one day for discussion and review; and one day to sample the results. Some will say that is too much time to allow for a field trip but, if it is made a part of a unit or problem, it becomes but an integral part of the whole.

Here is how it can work. I will use our advanced biology class for an example because one of the boys took his camera along and secured some good pictures. The class was studying elementary bacteriology. They were learning some of the techniques for using the various types of equipment. Around

FIG. 1. City pupils, especially, enjoy experiences with farm animals during trips to dairies. Here one boy scratches the nose of a calf, while other pupils look on interestedly.

this study, five field trips using community resources were planned. The first was a dairy farm, where a local farmer demonstrated how clean milk was taken from the cows and prepared for hauling to a city dairy. Students were shown how the animals were cared for and how every effort was made to produce sanitary milk. They inspected the milk house, scratched the noses of the calves (Fig. 1), and petted the cats. When they left, they had a better idea of the problems of the dairy farmer.

The second field trip was to a local city dairy. Here the processing of milk was followed from the time it came off the hauling trucks until it was bottled and placed in the cooler. Questions were asked and answered concerning the pasteurizing process, the sanitary measures taken in handling milk, and the various tests made in the laboratory. Perhaps the chief value from such a field trip is the opportunity for the class members to appreciate the cooperative measures that are carried out between the city dairy and the farmer to produce and deliver sanitary and wholesome milk to their doorsteps.

The third and fourth field trips were to the local water treatment plant and to the sewage treatment plant. Here the students were shown the way water samples were checked and tested (Fig. 2) and the procedures necessary to produce safe drinking water. At the sewage plant, they learned how the action of bacteria changes the wastes to harmless substances.

The final field trip in the series was to the biochemical laboratory of a local chemical company, our largest industry. Here, through the cooperation of the laboratory personnel in the divisions of bacteriology and toxicology, the students were shown the practical application of the fundamentals they were learning. It was interesting to note their surprise at

FIG. 2. Pupils are shown how water samples are checked and tested for purity.

the problems presented by bacteria, yeasts, and molds, and the methods used to solve these problems. They also gained a better understanding of the part research plays in industry and the extent to which an industry goes to eliminate health hazards from the materials it produces. They were quite impressed with the microtome (Fig. 3) and the part it played in making it possible to keep permanent records of the toxic effects of various chemicals on varieties of tissues.

Last, but not least, the pupils are given a test after each field trip. You will note in the pictures that each student carries a note pad. I feel that note-taking is important, so each student is required to take notes. To make this part easier, and to make certain that the important information is taken down, we discuss the field trip before we go. We list the information that we want to get. In this way, if certain points are not covered by the person doing the explaining, one of the students asks to have them explained. During the first class period following the field trip, we get out our notes and discuss them. By pooling all of our information, we discover errors in note-taking. The next day the test is given.

FIG. 3. Note-taking is required on field trips. Here pupils are quite impressed with use of the microtome.

Using your community as a laboratory is excellent public relations for your school. You are acquainting the community with what is going on within your department. You will be surprised at the cooperation you will receive from your fellow citizens. The pupils receive a broader view and a better understanding of their local environment. Why not plan now to make the best use of what your community has to offer?

ORCHIDS TO WARD'S NATURAL SCIENCE ESTABLISHMENT for the NABT folder they prepared for nationwide distribution. In case you haven't seen it, the folder is double-fold letter size, with the following as part of the text: "Ward's Natural Science Establishment, Inc. deems it a privilege to print this 'Invitation to Membership' as a special service to The National Association of Biology Teachers. Ward's urges all teachers of biology to join the Association and thus assist its members in carrying on their efforts to promote and improve science teaching at the secondary level. . . . You can learn more about Ward's through a free subscription to Ward's Natural Science Bulletin which is published five times a year. Send your name and institutional address along with the subjects you teach to receive Ward literature without obligation."

The folder includes information about NABT, the names of officers, and a subscription blank.

Remember to write Ward's for their literature. The address is 3000 E. Ridge Road, Rochester 9, N. Y.

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help Managing Editor Beuschlein hold the advertisers who are now supporting *The American Biology Teacher*. The firms who advertise in our journal know that their advertising is effective only when *you* write to them, expressing interest in their products. So please make yourself known, and tell them you saw their ad in ABT. This is a contribution every reader can make.

A High School Biology Laboratory Exercise Illustrating Mendel's 3-1 Ratio

H. SEYMOUR FOWLER
Assistant Professor of Science, Southern Oregon College of Education

While teaching secondary school biology in the Dryden-Freeville Central School in Dryden, New York, the author was faced with the problem of finding a means of demonstrating the Mendelian 3 : 1 ratio effectively. Numerous methods have been described in which study skins, pictures, coins, charts and other inanimate things were used to illustrate the 3 : 1 ratio. However, science biology is the "Science of Life," a method using living things as experimental material was thought more appropriate. The possibility of using *Drosophila* was examined. At the high school level this animal did not seem suitable. A number of reasons underlie this decision. First, there was the expense of getting pure strains. Also, there was the problem of preparing culture media and the difficulty encountered by high school students in handling these animals with any great degree of efficiency. Most other experimental animals possessed life cycles which were so long in duration that they could not be considered as satisfactory experimental material. Consequently an investigation into possibilities within the plant kingdom was made.

From an inspection of catalogues of biological supply houses, it was found that corn segregating 3 : 1, green to albino, could be purchased. About this time it was also learned that the Sorghum Investigations, Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas, Rural Route 1, Lubbock, Texas, could and would supply packets of sorghum seeds which differentiated 3 : 1, green to albino. The decision was made to try this experimental material. Since the experiment proved both satisfactory and worthwhile, the author would like to pass on the method to other teachers.

The class was divided into teams. Each team was composed of two members. Each team was equipped with a flat box similar to those in which tomato plants are sold, a source of garden soil and one hundred sorghum seeds. Instructions for planting and caring for the seed bed were included in the laboratory directions. Each student made notes covering the progress of the growth of his seedlings. As the color differences emerged much student interest was aroused. It is believed that this was due, in part at least, to the fact that the students were not informed in advance of what they might expect.

The seedlings also grew in such a manner that another plant property was demonstrated rather nicely. It so happened that the boxes with developing seedlings were placed at the side of the laboratory opposite from the side containing windows. All of the tops of the seedlings grew noticeably toward the light. In fact so much so that it appeared that a strong wind had bent them all in one direction. This turned out to be a perfect example of phototropism.

When the seedlings had attained about one and one-half inches of growth the students were instructed to count the number of green seedlings and white seedlings and to compute the number of seeds which had not germinated. From this, the idea of percentage of germination was developed. It was deemed essential to convey to the student the idea that this percentage of germination, which was determined by them, could

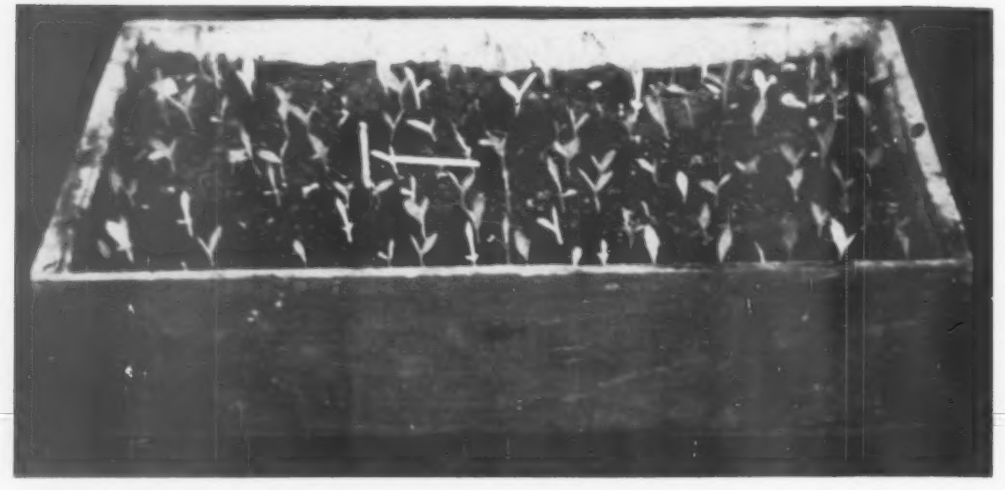

Photo print made from a 35 mm. color transparency, showing a flat with growing sorghum seedlings. Note the two match sticks placed among the seedlings for size comparison.

not be represented as the actual percentage of germination since our methods were rather crude. This presented the opportunity of emphasizing another part of any scientific experiment. That is the inclusion in the write-up of the conditions under which the experiment was performed. The results of all the experiments were then combined so that a large total number of seedlings was possible. In the case described here there were 25 teams, so the total number of seeds planted was 2500. In this case the ratio was found to be 2.8 : 1, green to albino seedlings. This led to a discussion as to why the result was 2.8 : 1 instead of the expected 3 : 1 ratio. The class soon determined that this experiment dealt with a small number of seedlings and if seeds enough to plant an acre had been used then perhaps the ratio would have approached more closely a 3 : 1. The seedlings were observed for many weeks. As would be expected, the white seedlings grew to a height of about 3 inches or less and then wilted and died. This offered an opportunity of including the concept of the lethal gene and also the concept of the dependence of living things on chlorophyll-bearing plants.

It is not difficult for a biology teacher to see the wealth of stimulating questions which can be derived from this type of experiment. One of the important points, however, is the fact that many of the students who would have had difficulty in understanding this simple Mendelian principle now understand it adequately enough for their needs. With this as a foundation, other more complex genetic ratios can be developed.

Ass't Editor's note: If some of the young seedlings are covered with a light-proof can or box just before the epicotyls emerge from the soil, and the can or box removed after about one week, a striking comparison may be noted which will help pupils to see the effect of light on the production of chlorophyll and upon rate of growth in height of the seedlings.

NOTICE TO CONTRIBUTORS

All full length articles intended for publication in *The American Biology Teacher* should be sent directly to the Assistant Editor-in-Chief, B. B. Vance, Daniel Kiser High School, Dayton 4, Ohio. News, notes, letters, and short items of all types should be sent to the Editor-in-Chief. If you want a copy of *Preparation of Manuscripts for Publication*, you may get it from the Editor-in-Chief, Assistant Editor-in-Chief, or Secretary-Treasurer.

Editorial Comment

At the beginning of the school year the editor should make a statement including all the old cliches about the journal belonging to the readers and so on; all the old cliches are true, of course; that's how they came to be cliches. The editor's life is a great one—a letter from California wants the magazine to cater less to easterners (which includes anyone east of Arizona) and one from Massachusetts wants the journal to pay less attention to westerners (which means anyone west of the Hudson). An indignant letter says "why in the world do you print such utterly worthless stuff as Joe Doakes' article on Sanskrit Taxonomy?" and in the same mail comes an order for 1000 reprints of the article. Two readers complain about book reviews—one to say that they are too long and formal and the other that they are too short and informal. But all is not contradiction and disagreement; there are some majority opinions. The only trouble is that the editor has no way of knowing what they are unless the readers make themselves known. That is one thing this little editorial is all about. Write the editor a letter once in a while, and give him permission to publish it. Mail discussion in the columns of *The American Biology Teacher* is just as good as any other kind.

The cover pictures will be of interest only if many are submitted by readers. The cover will be as striking and interesting as you make it; if you have a good clear photograph of a teaching situation and you would like to see it on the cover of *The American Biology Teacher*, send it in. It should be a glossy print not smaller than 5×7.

Beginning with the January issue, the columns of the journal will be somewhat wider and the margins somewhat narrower, thus getting more material on a page and increasing the capacity of the magazine without increasing the number pages. The 32-page size is more economical per page and more efficient than the 24-page size, and it is the hope of the editorial staff that 32 pages may become the standard. With increased membership and increased advertising, this will be possible. Here again is the place to say that each member can help to get other members interested and can write to the advertisers and let them know that he saw their ads in *The American Biology Teacher*.

The staff is particularly anxious to receive articles on elementary biology education, practical articles on laboratory aids and teaching aids, illustrated articles and news items dealing with activities of local biology organizations.

Election Notice

(The Nominating Committee appointed by the Executive Board has submitted the following list of nominees for officers of The National Association of Biology Teachers for the ensuing year. The Secretary-Treasurer is sending ballots to all members.)

For President-elect:

ARTHUR J. BAKER—Biology instructor, Crystal Lake Community High School, Crystal Lake, Illinois; graduate, Whitewater State Teachers College; M.S., Marquette University; advanced study at University of Illinois. Charter member of NABT and regular contributor to *The American Biology Teacher*, Health Committee of NABT and membership chairman for Illinois; second vice-president, NABT, 1952; chairman of membership and conservation project for Ohio, Ill., Ind., Mich. and Wis.; sponsor of a high school

Health Project which has won national recognition, pioneer in education for family living and member of a statewide committee working on a course of study for this field of education.

ROBERT C. MCCAFFERTY—Biology instructor, Wadsworth High School, Akron, Ohio; B.S., M.S., and one additional year, The Ohio State University. Taught 18 years in Ohio high schools, also extension instructor, Kent State University, Kent, Ohio. For one year an employment manager in Columbus. Was secretary and later vice-chairman, Biology Section, Central Ohio Teachers Assn.; first vice-president, The Wadsworth City Teachers' Assn.; and associate editor, *The American Biology Teacher* for 5 years, to which he has contributed briefs, reviews, and 5 articles. Membership in 10 professional organizations, including the ones with which NABT is associated, especially in connection with the annual meetings; first vice-president, NABT, 1952; national membership chairman, 1951–52; charter member.

For First Vice-President:

LYDIA ELZEY—State College, Pennsylvania; B.S., Wayne University, in education; M.S., University of Michigan, in biology; experience, 22 years teaching elementary science and biology in Michigan public schools, three years as assistant professor at Penn State, seven summer sessions as consultant in conservation education laboratory; has held various offices in local science organizations (Detroit Biology Club, Metropolitan Detroit Science Club, etc.), served on various committees in NABT, currently on conservation project committee.

MALVINA TRUSSELL — Tallahassee, Florida, Florida State University; B.S., Georgia State College for Women, M.S. and Ph.D., Cornell University. Has taught from first grade through university, twenty-three years at Georgia Teachers College, serving as head of the biology department, science consultant in workshop in Florida and Georgia, one summer at the University of Minnesota; content material for teachers in the various sciences along with methods and techniques for presentation, author of articles to aid teachers with their work in science, published in Georgia Education Journal; editor of the *News Letter*, organ of the American Nature Study Society.

For Second Vice-President:

BROTHER H. CHARLES, F.S.C. (Charles F. Severin)—Professor of Biology, Saint Mary's College, Winona, Minnesota; B.S., M.S., Ph.D., Chicago; 16 years of teaching in high school, 19 years of teaching in college, author of a textbook in high school biology, a workbook for high school biology and a handbook for biology teachers, founder of Chicago Catholic Science Teachers Association, member of numerous educational and scientific societies; charter member of NABT; author of numerous articles in *The American Biology Teacher* and other journals; associate editor of ABT since 1940.

SISTER M. GABRIELLE MAZE, O.S.F.—St. Francis Academy, Mt. Providence, Pittsburgh 27, Pa.; B.S., Duquesne University, M.S., University of Pittsburgh, continuing for Doctorate at University of Pittsburgh; principal for 30 years in elementary and secondary schools of Michigan and Pennsylvania; community school supervisor for the elementary and secondary schools; research; "Animals that Produce Galls in Allegheny County" reported at Pennsylvania Academy of Science, Publication; articles in The American Biology Teacher, Science Counselor and Proceedings of Pennsylvania Academy of Science; chairman of biology section, 1949–1951, vice-president, 1951–1953, of the Pittsburgh Diocesan Science and Mathematics Teachers' Association, inaugurated "The Biology Institute Day"; active member of many educational and scientific associations, regional chairman of the Pittsburgh section of the Junior Academy of Science, member of Pittsburgh Catholic Schools Board of Supervisors, editorial staff of the Science Counsellor.

For Secretary-Treasurer:

JOHN P. HARROLD—Biology instructor, Senior High School, Midland, Michigan; B.S., Western Michigan College of Education; M.S., University of Michigan; advanced study at

Michigan State College. Member of numerous educational and scientific organizations, Michigan membership chairman for NABT in 1947, Secretary-Treasurer since 1948; specially interested in conservation and in science curriculum coordination between elementary and secondary grades.

Constitutional Amendments

Proposed Changes in the Constitution of THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS as prepared by the Committee appointed in 1951: Dr. George Jeffers, Dr. Prevo Whitaker, Mr. Clyde Reed, Dr. Richard Weaver, Dr. D. F. Miller, chairman, and the additional members appointed in 1952: Dr. George Jeffers and Miss Ruth Dodge, chairman. Mr. John Harrold and Mr. Robert McCafferty have also made suggestions which have been considered.

After due consideration of all the proposed changes the following is submitted for your consideration:

Article IV—Officers and Governing Boards

Section 3 has been changed to "Executive Board."

Section 4 has been changed to "Functions of the Executive Board."

Section 5 has been added to include "Board of Directors" instead of "Representative Assembly" as in the previous Section 3.

Section 6 has been added to state functions of the board.

Section 7 has been added to include "Regional Chairmen."

Article II of By-Laws—Section 2

Suggestion that twenty-five members may be sufficient to propose nomination.

Article III of By-Laws—Section 3

Delete as it has already served its purpose. Also minor changes in editing.

EDITOR'S NOTE: This announcement of the proposed revisions is included in the October issue in order to meet the 60-day notice requirement. The full proposed revisions will be printed in the November issue.

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COVER PICTURES

All readers are invited to submit pictures—scenics, teaching situations, home made gadgets, candids, nature study pictures, or what have you. Glossy prints of 5×7 inches or larger are preferred. Send with the picture any interesting data—kind of camera, kind of film, exposure, any special circumstances. In case of seasonal pictures, allow plenty of time.

APPLICATION FOR HOTEL RESERVATIONS

St. Louis, Mo., December 26 - 31, 1952

The list of hotels and their rates and the reservation coupon below are for your convenience in making your hotel room reservation in St. Louis. Please send your application, *not* to any hotel directly, but to the AAAS Housing Bureau in St. Louis and thereby avoid delay and confusion. The experienced Housing Bureau will make assignments promptly; a confirmation will be sent you in two weeks or less. **Share a room with a colleague if you wish to keep down expenses.** Mail your application *now* to secure your first choice of desired accommodations. All requests for reservations must give a definite date and estimated hour of arrival, as well as date and approximate hour of departure.

HOTELS AND RATES PER DAY

Hotel★	Single	Double Bed	Twin Beds	Suites
CHASE	6.00– 9.00	8.00–10.00	8.00–12.00	14.00–30.00
DESOTO★D	4.00– 6.00	6.00– 9.00	7.50–14.00	11.50–22.00
JEFFERSON★D	4.50– 8.50	7.50–11.00	8.50–11.50	19.00–30.00
LENNOX D	5.00– 7.00	6.50– 9.00	8.50– 9.50	13.00 & up
MAJESTIC D	3.25– 4.50	5.25– 6.25	7.00– 8.00	10.00–15.00
MARK TWAIN D	4.50– 6.50	6.00– 8.50	8.50– 9.50	16.00 & up
MAYFAIR D	4.00– 7.00	5.50– 8.00	8.00–12.00	15.00 & up
MELBOURNE	4.50– 8.00	6.50– 8.50	8.50–11.00	17.00–25.00
ROOSEVELT	Reserved for mathematicians, $2.75 to $3.75 per bed.			
SHERATON	5.25– 8.85	8.00–11.00	9.00–12.50	11.00–30.00
STATLER★D	4.00– 7.00	6.50– 9.50	7.50–11.00	21.50–26.50

★ Hotels starred have sessions in their public rooms. For a list of the headquarters of each participating society and section, please see Association Affairs, *Science*, July 25, or *The Scientific Monthly*, August.

D = downtown hotel; the other hotels (not downtown) are for the mathematicians primarily.

THIS IS YOUR HOTEL RESERVATION COUPON

AAAS Housing Bureau
Room 406—911 Locust St.
St. Louis 1, Mo.

Date of Application .....

Please reserve the following accommodations for the 119th Meeting of the AAAS in St. Louis, Dec. 26–31, 1952:

TYPE OF ACCOMMODATION DESIRED

Single Room ..... Desired Rate ..... Maximum Rate .....
Double-Bedded Room .... Desired Rate ..... Maximum Rate ..... Number in party .....
Twin-Bedded Room ..... Desired Rate ..... Maximum Rate .....
Suite ..... Desired Rate ..... Maximum Rate ..... Sharing this room will be:

(Attach list if this space is insufficient. The name and address of each person, including yourself, must be listed.)

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First Choice Hotel ..... Second Choice Hotel ..... Third Choice Hotel .....

DATE OF ARRIVAL ..... DEPARTURE DATE .....
(These must be indicated—add approximate hour, a.m. or p.m.)

NAME .....
(Individual requesting reservation) (Please print or type)

ADDRESS .....
(Street) (City and Zone) (State)

Mail this now to the Housing Bureau.

Rooms will be assigned and confirmed in order of receipt of reservation.

Phosphorus in Biology and Medicine

KARLEM RIESS
Tulane University, New Orleans, Louisiana

The element phosphorus was discovered by Brand in 1669. Its widespread occurrence in nature as phosphate rock, in soil and in the bones and teeth of animals is well known. The chemistry of phosphorus and of the phosphorus halides, oxides and acids is a part of every basic course in general chemistry. The biochemists tell us that phosphorus is found in many complex organic compounds in the human body—in phosphatids (phospholipids), nucleic acid, phosphoproteins (e.g., casein), adenylic acid, coenzymes, yellow enzymes, thiamin phosphate, phosphocreatine, hexophosphates and triosephosphates. It is estimated that the human body contains around 700 grams of phosphorus, of which 600 are in the skeleton, 57 in muscle, 5 in the brain, etc. The daily requirement of the body is less than 150 grams. Some of the recent experiments with radioactive tracers have used radioactive phosphorus and these have revealed much about the behavior of the element in vital processes of plants and animals.

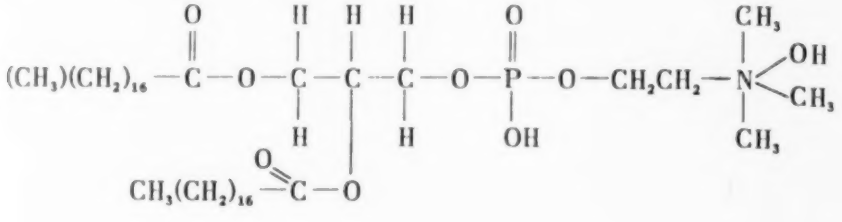
Radioactive phosphorus, P^{32}, is usually administered as a phosphate, $KH_2P^{32}O_4$, $NaH_2P^{32}O_4$ or $Na_2HP^{32}O_4$. The isotope gives off beta rays of low penetrating power, which are readily detected. About 50% of the beta radiation is absorbed in one millimeter of tissue. The P^{32} is prepared by neutron bombardment of chlorine or by alpha bombardment of silicon.

Following oral administration Hevesy found that most of the radiophosphorus accumulates in bone tissue (1). Cohn and Greenberg listed, in decreasing order of retention, per unit weight, the liver, gastrointestinal tract, heart, kidneys, lungs, blood, muscle, skin and brain. The isotope was also located in the lymph nodes, urine and feces. Most of the phosphorus is excreted through the kidneys, if administered intravenously, and in the feces, if administered orally (2).

In the brain it is located in the pineal body, the anterior and posterior lobes of the hypophysis, in the plexus choriordeus, the cerebellum, the medulla and the spinal cord. Phosphorus penetrates readily into the red corpuscles.

The rate of retention of radiophosphorus is independent of the inorganic compound in which it is administered. The rate of excretion through the kidneys and feces is increased by the administration of vitamin D.

The production of phospholipids has been investigated by Artom and his associates (3). The greatest concentration of these compounds has been found in the liver, intestine, kidney, parenchyma, muscle and brain, in that order. A typical phospholipid is distearyl lecithin:



When tissues are grouped according to the value of their specific activity, as shown by their lipid phosphorus, the liver and intestine have a high value; heart, spleen and bones, low; central nevous system, very low. The turnover rates of phospholipids in tissues and plasma and the agents associated with the synthesis of these compounds have been investigated. Phospholipid formation is not dependent on the adrenal gland. Choline and lipotropic substances stimulate phospholipid turnover in the liver (4). Recently a very heavy deposit of phospholipids has been found in the nerve tissues of newborn animals (5).

A study of the muscle behavior of rats injected with radiophosphorus showed that the penetration of the phosphate into the muscle and its uptake into organic phosphates appear to go on at approximately the same rate in working and in resting muscles. The working muscle did show an increase of inorganic phosphate, probably due to the presence of phosphates released from the creatine, adenylic acid and other organic phosphates by processes of work (6).

A comparison between X-irradiated muscle and normal non-irradiated muscle showed that there is essentially no difference in phosphorus uptake. Since muscle tissue has a low permeability for phosphorus it tends to retain the radiophosphorus acquired during phases of high plasma content. The turnover rate in muscle, kidney and liver is affected by hyperthyroidism. A stimulated nerve, however, has a greater phosphorus uptake than resting muscle (7).

The presence of glucose tends to increase the absorption of phosphorus from the gastrointestinal tract. On the other hand iron salts decrease the absorption.

Low-Beer treated skin lesions with radioactive phosphorus in a unique manner. A piece of ordinary blotting paper moistened with $Na_2HP^{32}O_4$ solution was applied to skin tumors and similar lesions. The threshold erythema for radioactive phosphorus used in this manner was found to be 34 microcurie-hours per square centimeter (8).

The uptake in tumor tissue is very rapid. Most tumors take up larger quantities of radiophosphorus than normal tissues. Experiments with breast tumors have shown that there is a considerable concentration of radioactivity on the surface of the skin over the tumors. Those tumors which, after surgery, proved malignant, showed about a 25% higher activity than normal areas (9).

Several studies have been made investigating the role of phosphorus in egg formation. $NaH_2P^{32}O_4$ injected into laying hens showed that the bulk of the phosphatides in the yolk originated in the liver. Radioactivity in the yolks increased to a maximum five days after the injection of the phosphate, and then decreased. Chickens were fed a laying mash containing radioactive calcium phosphate. Twenty-four hours after feeding a large portion of the phosphorus was located in the shell. Most of the unabsorbed phopsphorus was excreted within one day after feeding. A large amount of the absorbed phosphorus was found stored in the tibiae as late as forty days after the initial feeding (10).

Hunt and Wolken have made a detailed study of the distribution of phosphorus in early chick embryos. One ml. of phosphate was injected into the albumen of each egg. A complete set of radioautographs was obtained for all stages of development. The primitive ridges showed a high concentration initially, then the entire primitive streak region and headfold, and, in later stages, the brain and optic vesicles (11).

The administration of parathyroid extract to patients is often accompanied by the increase in the phosphorus content of the urine. An explanation of this was thought to be a linkage between the parathyroid extract and changes in the phosphorus metabolism of the bones, kidney and liver. Intraperitoneal injections of radiophosphorus and parathyroid extract into rats were made by Tweedy and Wesley (12). Urine and feces were collected and the animals sacrificed. There was no difference in the phosphorus content of the blood of test animals and control animals. The liver and kidneys of the test animals retained larger amounts of phosphorus than the controls. The phosphorus content of the femur was initially higher in the test animals, but after twelve hours decreased more rapidly than the controls. The treated animals showed an increase in urinary phosphorus and a decrease in fecal phosphorus.

This isotope has also been used with some success in the treatment of chronic leukemia and polycythemia vera. Following treatment with radiophosphorus patients showed almost complete symptomatic relief and, in about 85% of the cases, hematological remission. The use of the isotope in cases of polycythemia vera caused a reduction in the circulating erythrocytes and in blood volume, and a congestion of conjunctival vessels. The isotope is ineffective in acute leukemia, Hodgkin's disease and multiple myeloma.

Corn was grown by gravel culture methods under fluorescent light. After the first silk appeared the labeled phosphorus was introduced into the nutrient solution as $KH_2P^{32}O_4$. Radioactivity seemed to be concentrated in the phytin phosphorus fraction (13).

Sunflower plants grown in nutrient media showed a rapid exchange of circulating phosphate with the phosphorus in the leaves. New leaves contained the radioactive material, while the old leaves showed a small amount of pick-up.

Giles has been able to produce chromosome structural changes in *Tradescantia paludosa* microspores by the absorption of radiophosphorus. Cut ends of inflorescences were inserted into beakers containing radioactive phosphates, properly shielded. The uptake of phosphorus increased for the first eight hours after insertion, then remained approximately constant for about four days. The structural changes observed were similar to those induced by X-rays or neutrons. Chromatid changes occurred with relatively high frequency, and, after the fourth day, chromosome breaks (14).

Turkish tobacco plants infected with tobacco mosaic were grown in a nutrient solution containing labeled phosphate. About 30% of the phosphorus taken up by the plants was located in the mosaic virus, probably in the ribonucleic acid molecule (15).

Escherichia coli and *Staphylococcus aureus* were grown in cultures containing radiophosphorus, and then injected into rats. The radioactivity was present in the liver and intestines, with a minimum in the brain (16). Encysted larvae of *Trichinella spiralis* two hours after feeding contained a quantity of radiophosphorus (17).

Hamsters were treated with radiophorus, doses ranging from 1–10 microcuries per gram of body weight. Those receiving the larger doses died within eleven days. Doses of 6–8 microcuries per gram produced extensive damage to the testes within one month. The testes were reduced in size, and the spermatogenic cells were absent from the tubules (18).

These experiments have been chosen to illustrate the many facets of the problems of phosphorus metabolism, distri-

bution, translocation and excretion. It is only by such research projects as these we will be able to understand the complex problems associated with phosphorus.

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BOOK REVIEWS

WIEMAN, H. L. *An Introduction to Vertebrate Embryology*. 2nd ed. McGraw-Hill Book Company, New York. ix+412 pp. illus. 1949. $5.00.

This excellent text is written for both general and pre-medic students. It will be more effective if used with atlases of sections and a laboratory guide. The material discussed briefly encompasses development from the frog through man. Concrescence seems overemphasized, confluence and epiboly were not mentioned. Müller was consistently printed Muller. Müllerian was printed Mullerian. This is no doubt typographical since there were few errors of fact. Some sections were especially interesting, one of these was the account of the physiology of the allantois. In fact the author has commendably injected considerable physiology into morphological accounts of development. He apparently regards the adult as an egg's way of producing other eggs.

JAMES M. SANDERS,
Chicago Teachers College, Chicago, Illinois

STORER, TRACY I. *Laboratory Manual for General Zoology*. 2nd ed. McGraw-Hill, New York. viii+150 pp. illus. 1951. $2.50.

The first paragraph of the Preface contains an excellent general description of this manual. It is, therefore, quoted below:

"This manual is designed for the general introductory course in zoology in college or university. It includes some general instructions for students, detailed exercises on the structure and physiology of the frog, others on the general principles of animal biology, and a series on common representatives of the principal groups of invertebrates. Each exercise gives detailed instructions to guide the student in making dissections and carrying through other laboratory procedures, and also includes questions to focus attention on the important observations and conclusions to be made with each type of material. Other questions deal with related subjects or animals, including some practical topics. Descriptions and illustrations of the various animal forms, and other information about them, together with discussions of general zoological principles, will be found in the author's textbook, 'General Zoology' (McGraw-Hill Book Company, Inc.)"

PHILIP E. FOSS,
Hartford Public High School, Hartford, Connecticut

BIOLOGY LABORATORIES

BY "THE OLD FOSSIL"

At Wells High School, Chicago

PLANT WATERING over long week ends may be solved. You should use any watertight metal container of large size which is a few inches deep. Place about four inches of an absorbent material in it. The material may be peat moss, vermiculite, sand, or similar material. Pour water into the material until it becomes quite damp. Plunge your potted plants into this material. Your plants will not dry out, become waterlogged, or drowned out. Experimentation will reveal how damp to make the material. You will soon be sold on the idea.

CONSULT YOUR FILM supply dealer for the following films:

The Onion, eleven minutes; growth from seed to seed harvest; elementary and secondary school level.

The Rabbit, eleven minutes; good on the reproductive system, emphasis is on the economic importance of the animal.

The Rabbit Development, thirty-three minutes; a comparative embryological development thru: sea urchin, frog, chicken, monotreme, marsupial to rabbit.

The Newt, ten minutes; general on the three common types of newts.

Vegetable Insects, twenty-three minutes; economic entomology, many types are discussed, the modern methods of control are explained in pictures.

MORDELLIDAE QUICKENS THE PULSE of but five close associates in our biological world. One is behind the Iron Curtain and is formal in his relationship with the other four. One of the four is in Japan, another in central Europe, a third in Italy, and a fourth, Mr. Eugene Ray, here at Wells (an experimental) High School, Chicago. *Mordellidae* (a group of insects) has but one descriptive name, "tumbling flower beetles." They are so called because they "tumble" when trying to escape as they are shaken from the flower into a net. They are pollen feeders. Their life histories are unknown. One is a minor pest on alfalfa. Another is a stem pest of one of the orchids. Mr. Ray has described approximately 250 genera and species. He has toured many of the Pacific Islands in his search. He has received consignments from all over the world. He works not only as a secondary school teacher at Wells but is also a part time worker with the Natural History Museum, Chicago. He is now in the process of publishing a monograph on the subject. New species are constantly being found. For you that are interested he is always glad to receive new material.

CHLOROPHYLL; perennially under foot, or in our nonfolding variety of lettuce, now appears in our dentifrice cleansing agent. Three of my best friends and of long standing are dentists. One was a classmate. One is a neighbor. The third has rented his office space from me for years. They attest to the power of chlorophyll. Dr. William F. Kangas, Chicago, "It is the only known inhibitor of caries once caries has started." Dr. Walter Ladwig, Elmhurst, Illinois, "I recommend it to all my patients." Dr. J. A. Hafert, U.S.N.R., Fulton, Indiana, "Fluorine for children's teeth; ammonia for prevention of caries; chlorophyll for inhibiting caries progress; these are the three important finds in dentistry in recent years."

THE DOG GONE after the skunk may return with a skunk odor. This, however, will be the only odor he will have provided you feed him chlorophyll supplemented dog food. According the hucksters of this product it is supposed to kill any of his body odors. That is provided he eats it for a week as a steady diet. TOF suggests a thirty-minute turn with a tub, brush, warm water, and shampoo. Then let your pet pup take his routine stint for the balance of the week with his favorite bone.

PLANT FEEDING TIME is when plants approach a growth period. Some growth periods are bud formation, spring leaf development, flower production, and fruition. If one of these periods of growth extends over several weeks a light feeding should be repeated at the end of three or four weeks. Another

feeding time is when temperatures, light, and water begin to increase toward their optimum. Plant feeding should be avoided when your plants are going into a dormant period. Dormancy happens in the late fall as grasses, perennials, trees, and shrubs are entering their winter rest period. This also happens to the plants you have in your home, classroom, or greenhouse whenever temperature, light and other growth factors are at a minimum or are diminishing. You may add cold drafts and extreme temperature variations over a twenty-four-hour period. If you do feed your plants at these times they have a rank, soft, succulent growth. If plants are in this condition they will easily winter kill or develop leggy plant parts. Both conditions are undesirable.

PURCHASING PLANT FOOD depends upon your needs. Manures not only furnish the three important food elements but also are composed of desirable organic matter for good soil tilth. The chemical fertilizers are about one fifth available chemicals and the balance inert filler. Commercial fertilizers (manures or chemical mixtures) may be bought by the ton, one hundred pound sacks, or small bags and paper boxes. A few pounds cost less than a dollar. Some plant foods are packaged as a liquid (generally water containing the soluble plant food materials). A few of these are fortified with vitamins. TOF has his doubts about this latter addition as a valuable adjunct. You may also buy the three important food elements separately. Nitrogen may be purchased as ammonium nitrate. Phosphorus is found in phosphate rock. Potassium may be bought in one of several of the salts.

SCIENCE FOR BETTER LIVING; Brandwein et al.; Harcourt, Brace and Company; 1950. This is a full year's course for eighth or ninth grade. It receives very excellent reviews.

STRANGE SEA LIFE; Robertson and Graham, New York; Henry Holt and Company; 1950; elementary school level.

INTERNATIONAL LIVE STOCK SHOW held in Chicago is an excellent means to maintain biological interest. The thirtieth, which was held last fall, was a good one. I requested my students in each class to save clippings and write-ups for a livestock notebook. For over two weeks each of the four metropolitan papers carried from three to eight pictures of the show in every edition. Also, there were available profused write-ups, editorials, and cartoons on the show for their selection.

THE MICROSCOPE, as a teaching aid, is being neglected. This is true in many of our beginning biology courses. It has much to offer the student which could be of interest to him. A demonstration microscope set up in a convenient part of the classroom will always be a focal point of interest for pupils. Living material for this purpose is abundant. Prepared slides are also helpful. Both are easily secured. The next time you order supplies place emphasis on a large selection of prepared slides. If you need living material include it on your requisition. Be sure to make a note on the order as to the date you desire the material to be delivered. Most supply houses will accommodate you and deliver the living material at the time you specify for its delivery.

HALF CENTURY COLLECTING EXPERIENCE is a long time. However, this is the record set by C. M. Goethe of California. He writes, "Just a word of very deep appreciation of your *How to Succeed in the Study of Biology*. National Park nature guiding came from surveys Mrs. Goethe and I made of similar work in some six European countries. We saved money to support it, then commenced at Lake Tahoe." TOF wishes to thank Mr. Goethe for his nice letter. TOF is glad he obtained pleasure from the article, especially the section "*Collect Specimens*."

TOF LIKES AN O'HENRY ending for this paragraph. Something with a snap and a bit of witty comeback. After laboring with the above notes to this point for over ten weeks the only thing that comes to his mind is that he is very tired. Very tired. But not too tired to welcome a few letters from you. It may take weeks to get an answer from him but send them on to THE OLD FOSSIL, 5061 North Saint Louis Avenue, Chicago 25, Illinois. [It came out even—an ashtray full of cigarette butts and a final (.)]

NOTICE TO CONTRIBUTORS

Manuscripts for publication in THE AMERICAN BIOLOGY TEACHER should be typewritten, on one side only, on standard white paper, 8½ × 11 inch size, with a margin of at least an inch on all sides. The writer should keep a carbon copy for reference and as insurance against loss of the original in transit.

Articles are scheduled for publication in approximately the order of acceptance of the manuscripts. Generally the journal is tentatively arranged about three or four issues ahead, and there are under consideration at any time enough manuscripts for about two or three more issues. Some space is of course allowed for news items and articles of a seasonal nature. Many seasonal papers have to be postponed an entire year, simply because the author has not allowed the necessary four to six months that intervenes between acceptance and publication.

For details concerning titling, headings, references, illustration, etc., consult *Preparation of Manuscripts for Publication*, which appeared in the November, 1949, issue of THE AMERICAN BIOLOGY TEACHER. A limited number of reprints is available; copies may be obtained from the editor or from the Secretary-Treasurer.

Manuscripts may be sent to the editor-in-chief, assistant editor, or to any one of the associate editors. A complete list of the latter appears in each November and March issue.